Onslow County Schools (Jacksonville NC)

EDU 2011 Pilot Program

Final Report

October 31, 2012

Background

This program was intended to provide cell enabled devices to high school students utilizing applications targeted for use with various math classes. 333 devices were provided during the fall 2011 semester and approximately 593 devices provided for the spring 2012 semester. These include a combination of Android Tablets (397) and cell enabled netbooks (196). This program was designed to create resources for students with a goal of increasing their math skills. The program included all seven high schools in the district and the Onslow County Learning Center, an alternative learning setting. The math classes included Algebra 1 and 2, Geometry, Honors Geometry, Pre-calculus, and AP Calculus.

Project Benefits

The program encompassed instructional/administration applications accessible via web browser and accessible via various mobile devices deployed to students. Included applications were: K-Nect, Adobe Flash Player 11, Realplayer, Office Talk, Adobe Reader, AndyGraph, Astro File Manager, and Groupboard. The instructional/administration applications were designed to provide teachers and/or administrators with access to closed portal sites that provide the following functionality:

- Access to problem sets
- e-Content Repository
- Instant Messaging
- Assessment
- Management of the above

An instructional portal was populated with sequenced instructional units aligned and correlated to problem sets that support the North Carolina State Standards. Teachers were able to assign problem sets to the entire class or individual students. Delivery schedules were made available to the teachers based upon pacing guides and correlated to individual textbooks. Additional instructional resources were available through the e-Content Repository. This repository included web links to resources or files viewable on the devices deployed to the students.

The program included classes for both Fall 2011 and Spring 2012. All students were high school students taking various math classes. The devices were constantly used for participation in the included math classes. Devices were used to access material both on campus and remotely. Again, daily use was normal.

Onslow County Schools used a Third Party Evaluator, Project Tomorrow, for data collection and program benefit evaluations. The results of this evaluation are included in addendum A. Prior evaluation reports showing the efficacy of the 24/7 mobile device initiatives are attached as addendum B.

Project Costs

Excluding the purchase of tablets for the project, the off premise, non-discounted connectivity charges from October 2011 to September 2012 were $117,184.21. These charges were discounted $77,341.58, leaving Onslow County Schools to pay $39,842.63. This equates to approximately $7.17 per student per month.

Selected data usage statistics are as follows:

Total 3G Kbytes used:

- November 2011= 73,007,507
- December 2011 = 70,498,952
- January 2012 = 32,125,212
- February 2012 = 32,125,209
- March 2012 = 217,927,514
- April 2012 = 123,167,249

Average per student 3G Kbytes used:

- November 2011 = 217,933
- December 2011 = 152,595

- January 2012 = 69,686
- February 2012 = 69,686
- March 2012 = 369,987
- April 2012 = 310,245

It is important to note that during the month of January and a portion of February, the data usage dropped considerably due to the collection of devices from the students at the end of the fall 2011 semester and redeployment of devices to new students at the beginning of the spring 2012 semester.

Effectiveness of Protective Measures

Onslow County Schools utilizes Zscaler Web Security which leverages the cloud to deliver comprehensive protection against advanced and emerging threats. Because it relies on multi–tenant 100% cloud architecture, real–time security is provided without the need to deploy and manage appliances, software or agents.

Onslow County Schools security teams can create and deploy granular web-based policies — by user, group, location or action — for the tablets and netbooks deployed as part of the 1:1 initiatives ensuring CIPA compliance for any device issued to a student.

For Android Tablets, App Blocker and Safe Browser are also configured for added protection and to prevent the potential of any apps being added that are not approved for instructional use. Safe browser prevents searches that may provide inappropriate material.

Both teachers and students are provided training on how the devices will be used prior to deployment which includes how to use the devices safely. Teachers are constantly monitoring device use to insure students' safety.

Lessons Learned

Mobile Device Management (MDM) should be considered as a requirement for this type of program in the future. The management of applications without a MDM system in place is cumbersome. A MDM would also enhance the ability to track usage and provide added security.

Most of our campuses are wireless and ubiquitous in the classrooms associated with our 1:1 initiatives. 1:1 access on campus and outside of the classrooms is enhanced through the usage of broadband cellular services that are provided through the EDU 2011 initiative.

Addendum A:

The Onslow County 1-to-1 Math Initiative:

Leveraging Mobile Devices to Transform Teaching and Learning in High School Math Classes

Prepared by Project Tomorrow® for Onslow County Schools

"I would use a mobile device to help my students learn by doing fun activities so that would allow them to really comprehend what they are learning. It would be different than other classes because my students could actually learn what is being taught to them."

Onslow County High School Student response to the question: What if you were a teacher?

Introduction

Onslow County Schools has a rich legacy of leveraging emerging technologies to create engaging learning environments for students and teachers. The landmark mobile learning initiative, Project K-Nect, demonstrated to the nation that smartphones equipped with high quality educational content and appropriate social media tools could be a catalyst for transforming the

teaching and learning paradigm in math classes. The follow-on project, Onslow Connect, built on the success of the original lessons learned from Project K-Nect and expanded the access through the implementation of netbooks in high school math classes. In the current version of the implementation, over 1000 high school students and 34 teachers from seven district high schools are using a netbook or a tablet computer to support math instruction both in and out of school. The mobile devices are individually assigned to each student with the option for the student to take the device home for out of school access. The courses involved range from Algebra I to AP Calculus and include a varied set of implementation strategies and approaches that complement and support each teacher's individual practice and pedagogy. The culture of teacher empowerment within the district provides a fertile environment for teacher experimentation and innovation around the use of the devices within instruction. Parental support of the original mobile learning initiative has provided the foundation for the expanded implementation. And while the district's commitment to transforming the learning trajectory in the high schools was initially based upon a desire to close the achievement gap in math, that motivation is now expanded with the current implementation to include a focus on equitable access outside of school, improving student self-efficacy around math and changing teacher practice.

The students themselves are the best evaluators on the impact of the Onslow 1-to-1 Math Initiative on their learning and their future success. From data collected at the end of the 2011-12 school year, over 7 out of 10 high school students in the program (72 percent) said that having the mobile device was valuable for their learning both in school and out of school. From an in-school perspective, the students highly valued the change in the structure

and format of their math class with the incorporation of the mobile devices. The "new math class" was more focused on collaborations and shared learning opportunities. The "new math class" provided opportunities for students to create content using the devices and to leverage their knowledge to demonstrate proficiency in more meaningful ways. The "new math class" enabled stronger connections between students as well as between students and teacher. The "new math class" changed the student view on the importance and value of math for their future. And the "new math class" demonstrated to both students and teachers that learning math does not need to be a one size fits all formula, but rather can be personalized to fit particular student needs and to be responsive to different learning styles. The mobile devices by themselves did not create this "new math class." The availability of a mobile device in the hand of every student, however, enabled and empowered the teachers (and the students) to think innovatively about instruction and classroom practice, and to provide a dramatically differentiated learning environment for every student.

This evaluation report is therefore a continuing story. It documents the findings from the implementation of the Onslow 1-to-1 Math Initiative in the 2011-12 school year and provides insights for future mobile learning considerations. But the ending of the story is still unwritten as the lessons learned from this year's initiative will be leveraged to inform future projects within Onslow County Schools, the state of North Carolina and the nation.

Mobile Learning Trends

Each year, Project Tomorrow®, a national education nonprofit organization, facilitates the Speak Up National Research Project

and, as part of this initiative, tracks the increasing interest and growth in the use of emerging technologies to address the specific needs and aspirations of students, parents and educators for 21st century learning environments. As outlined in the Speak Up 2011 national reports, many emerging technology products and services are not only addressing instructional needs, but are also enabling greater personalization of the learning process, both in school and out of school. Within this context, the use of mobile devices such as tablet computers, netbooks and smartphones combined with wireless accessibility and social media tools stand out increasingly as a game changer in this movement to more personalized learning.

Over the past few years, the environment for mobile learning has matured with greater clarity around the key opportunities and challenges associated with student use of mobile devices within instruction. Several factors have contributed to this greater clarity today. The ongoing local fiscal challenges within school districts have propelled many school boards and superintendents to explore new ways to leverage technology options as a means to decrease costs or increase revenues. The explosion in personal access to highly powerful, fully featured computing devices had been a contributing factor as well. This personal access has a greater value than simple availability for usage, however. As teachers and administrators have become mobile device users, or mobilists, their appreciation for how these devices can support and enhance learning is exponentially increases. Finally, this clarity about the potential transformative nature of mobile learning is also enriched by the national interest and momentum around personalizing learning.

Since 2006, Onslow County Schools has been on the forefront of this national discussion on the value of using mobile devices

within instruction. From the first implementation of smartphones to the current mix of netbooks and tablets, the Onslow County Schools' mobile learning initiatives have demonstrated the value of students' connectivity to anywhere, anytime Internet resources and their teachers and classmates, and how the personalized learning environment enabled by mobile devices supports enhanced student achievement and teacher productivity. The Onslow County story is a critically important chapter in the national story about the potential of leveraging mobile devices within math class to personalize learning and one that continues to enhance the discussion with new lessons learned each year.

Project Evaluation Objectives

The primary objective of this evaluation period was to create a summative assessment of the impact of the 1-to-1 Initiative within the high school math classes in Onslow County Schools for the 2011-2012 school year. This evaluation work builds on the previous work done for Project K-Nect specifically, but includes an expanded set of schools, teachers and students using a range of different mobile devices. Of particular note this year was the inclusion of tablet computers as a mobile device for use within math instruction.

The key research questions that were driving this year's evaluation include the following:

- ***How do students' perceptions about or interest in math change because of participating in the Onslow 1-to-1 Math Initiative?***
- ***Are students who participate in the Onslow 1-to-1 Math Initiative more likely to demonstrate proficiency in math than students who did not participate in the program?***

- ***What is the impact of the program on students' 21st century skills (including communications and collaboration skills) and technology literacy skills?***
- ***What is the impact on the change in the device this semester and the related software on student outcomes and attitudes? Specifically for the students who have used other mobile devices within math class, what are the associated results of this product change?***
- ***How has the learning environment in the Onslow 1-to-1 Math Initiative classes changed because of the program? How does the Onslow 1-to-1 Math Initiative learning environment compare to other classroom environments in the district?***
- ***What is the impact on the Onslow 1-to-1 Math Initiative on teacher practice and productivity?***
- ***What are the view of the parents of the students in the project on the value of this initiative and their interest in supporting the growth of the initiative?***
- ***What can we learn from the project during these two semesters to inform other projects or development efforts?***

Methodology

The evaluation report represents directly the views of the 446 high school students who participated in the Onslow 1-to-1 Math Initiative during the 2011-12 school year and completed the online survey about their experiences using a mobile device in math class. These students were enrolled in a variety of math classes including Algebra I, Algebra II, Geometry Honors, Pre-Calculus, Advanced Placement Calculus and Advanced Placement Statistics and represented all seven of the high schools in the study. For comparative purposes, national data from Speak Up 2011 is also included. The evaluation team collected data through onsite classroom observations with seven different teachers at three high

schools in the district, in class focus groups with students, and the online surveys. Additionally, interviews with the participating teachers and school and district administrators provided new insights. Project Tomorrow staff also collected and reviewed some available class data on the end-of-course exams for Algebra I as provided by the Onslow County Schools staff.

Summary of the Findings

As has been detailed in past Project K-Nect reports, the lessons learned and key findings from the evaluation of the use of mobile devices within math instruction in Onslow high schools are rich and varied. For this evaluation report, we are focusing on five key findings that relate directly to the research questions and provide new information about the impact of such as project on future implementations. The five key findings are as follows:

1. **Teachers are empowered within Onslow County Schools to personalize the use of the mobile devices to meet their unique teaching style and instructional practice, and to address the particular needs of their students. Thus, the implementation of the netbooks and tablet computers in the classroom vary widely even within schools or amongst teachers with the same assignment. This rich tableau of implementation strategies provides a very tangible representative of how teachers can personalize instruction with the use of mobile devices in the classroom.**

2. **Correspondingly, students are personalizing their learning with the devices as well, both in school and out of school. The usage differences between the students with the**

netbooks and the students with the tablets are a significant finding from the evaluation study.

3. **The access to the mobile devices within math class is changing the students' self-perceptions of their abilities to be successful in math. Again, we noted differences in that math self-efficacy based upon the device that the student was assigned.**

4. **Students are keenly aware of the need to develop critical 21st century workplace ready skills and the use of the devices within math class is contributing to their development of those skills.**

5. **Based upon their experiences with using a netbook or a tablet computer within their math classes, the Onslow students have a unique perspective on the value and purpose of mobile learning. Additionally, given their front row seat on the implementation of this mobile learning initiative, they also have a variety of ideas on how to improve the implementation to better address student needs specifically.**

Detailed Findings

Teacher Empowerment and Practice

The most recent Speak Up report on mobile learning *"Learning in the 21st Century: Mobile Devices + Social Media = Personalized Learning "* highlights the paradox that most administrators face today with the introduction of mobile devices into instruction. For many administrators this is one of the most perplexing challenges right now: how to change teacher practice and effectively leverage the capabilities of these multi-functional, always on mobile devices within instruction, while still tapping into the pedagogical and content knowledge and expertise of the classroom teacher. As noted in the report, "It is not sufficient anymore to simply overlay the technology onto pre-existing pedagogy and practice. Rather, mobile devices combined with wireless capabilities and social media tools provide a long overdue catalyst for educators to re-think the education enterprise and create more personalized learning environments for all students."

Through its longstanding practice of providing technology tools and resources to teachers based upon a competitive internal grant process, Onslow County Schools has changed the motivational structure for implementing technology within learning. Rather than simply installing expensive technology in classrooms and then expecting the teachers to use it, the district's approach has focused on supporting teachers that are already thinking creatively and innovatively about leveraging these tools to change their instructional practice and ultimately, student achievement results. The evidence of the value and success of this strategic approach to increasing teacher empowerment is demonstrated within the 1-to-1 Math Initiative. The results are two-fold.

First, based upon classroom observations, the teachers are highly customizing the use of the netbooks and tablets to address particular goals in their classroom. Those goals include:

- **extending learning beyond the math classroom time period**
- **increasing student engagement in the content**
- **providing individualized coaching and mentoring for remediation**
- **increasing both student and teacher effectiveness and efficiencies**
- **developing students' 21st century workplace skills**

The following vignettes represent a few examples of how the mobile devices are used in the Onslow classrooms to address these goals.

For her Geometry class at White Oaks High School, Janine Lesh used photos that she took while in Arizona to demonstrate different geometric shapes and concepts in a real world context. She emailed the photos to her students while on vacation so that they can view them in advance of class time and discuss them on the class blog. The students' personal access to a 3G tablet outside of class enabled her to bring the outside world into her instructional plan and to engage the students in a collaborative learning environment with their peers – all before any of them stepped into her classroom.

Suzette Kliewer, a veteran teacher within the Project K-Nect implementation at Southwest High School, used a mobile-enabled assessment tool, ClickerSchool, to do spot assessments on her students' grasp of key concepts. Using their tablets, the students responded to the easy to implement mini quizzes as a regular component of their class time. Ms. Kliewer could then provide personalized support and remediation to the students that most need it, right at the time they need it. Interestingly, the students enjoyed the visibility of knowing where they are compared to their

peers in the knowledge acquisition process. We were especially impressed during the observations to see students using that knowledge to provide informal support to their classmates as well.

Barbara Shedd in her Algebra class at Swansboro High School used a variety of media for her class's Town Distance Project and in that way, leveraged the students' netbooks to increase the efficiencies of the project and to extend the learning opportunity to other disciplines. While creating an imaginative town grid using the Cartesian coordinate system, the students also were asked to write a narrative story about their town and the locations on their grid. The students used their netbooks for the writing exercise and then uploaded their final documents to a dropbox for Ms. Shedd's review.

What was particularly striking in the classroom observations was the variety in the use of the tools and capabilities inherent to the devices by the teachers to personalize the learning process for their students. Other uses noted include the following:

- **Use of the Project K-Nect problem sets and animations to explain visually difficult mathematical concepts and to provide a foundation for student project based learning**
- **Increased communications between students and teachers through class blogs, wikis and email**
- **Creation of video archives of students solving math problems for post class review and remediation**
- **Use of other student response systems with the mobile devices such as Poll Everywhere**
- **Use of other device features such as the calculator, calendar and note taking areas within the class**

The second significant result of this increased teacher empowerment is the sustained change in teacher practice, and most notably that this change in teacher practice is teacher-initiated and in some cases appears to be transparent to the teacher. We know from our Speak Up National Research Project and other evaluation and efficacy studies, that the simple inclusion of any mobile device in the classroom by themselves will not change teacher practice. Even with strong professional development, the success of different implementations has been erratic. As evidenced by the 1-to-1 Math Initiative in Onslow County, however, the "secret sauce" for changing teacher practice to fully leverage the potential transformative nature of mobile learning appears to be the development of the culture of teacher empowerment that is present in the schools. The organic and seamless nature of that empowerment is particularly instructive for other implementations. In one class observation, the teacher, empowered to think creatively about her practice, and enabled with a tablet computer in the hands of each student, had effectively implemented a "flipped classroom" model. By having her students use their tablets to access online videos on key math topics as homework, she was able to use the valuable class time for both project –based learning activities and individualized student remediation. The teacher had not read anything about flipped classrooms or attended any conference presentations on that emerging trend; rather she leveraged her content expertise and understanding of her students' needs to create a more engaging, mobile enabled learning environment that changed her practice. True teacher empowerment at work.

Student Usage of the Devices

As discussed in this year's national report on the Speak Up 2011 Findings, *"Mapping a Personalized Learning Journey – K-12*

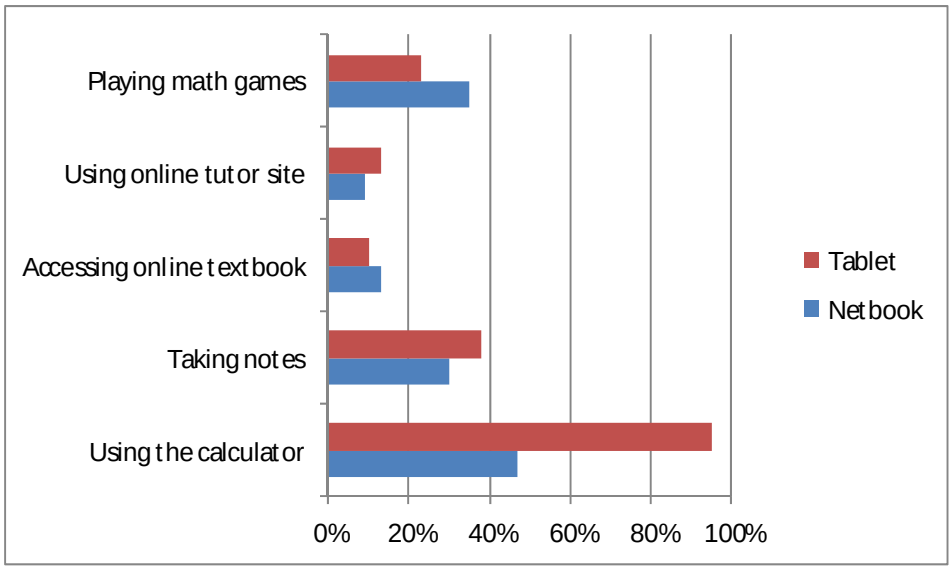
Students and Parents Connect the Dots with Digital Learning," **today's students are particularly interested in how emerging technologies can be used in their schools to create more personalized learning environments. For many students, including a majority of students in grades 6-12 nationally, the logical best tool for enabling personalized learning is an Internet accessible mobile device such as a smartphone, netbook or tablet. The Onslow 1-to-1 Math Initiative has employed both netbooks with wireless as well as 3G Internet connectivity and 3G tablet computers to address this student vision. The devices while ostensibly both providing extended learning opportunities outside of school and computing capabilities within the classroom have inherently different functionality and features that impact student usage. For this evaluation study, we examined how the students are using their devices both in and out of school to better understand the differences in the devices as math support tools.**

Given that the over three-fourths of the students who responded to the online survey about their mobile device usage were from Algebra I classes, our evaluation of the usage patterns focused exclusively on those students, which included a representative sampling of students with netbooks (131) as well as tablets (126). The students' usage of the devices can be divided into two general categories: using the devices to improve the effectiveness of their traditional schoolwork activities, and using the unique functionality of the devices to extend learning or personalize the learning process. Each set is viewed with the context of the particular student device – netbook or tablet. As would be expected the differences in the features of the devices can account for some of the usage differences.

As noted in Chart 1, the students are using their mobile devices to increase the effectiveness of "doing school" with some

differences based upon the device. The students with the netbooks were slightly more likely than their counterparts with the tablets to access an online textbook through their mobile devices and 52 percent more likely to play online math games on their netbook than those students with a tablet. Contrastingly, the tablet-using students were almost all using the calculator function on their tablet (95 percent); almost twice as many as their netbook-using peers. In our student focus groups, the students with tablets specifically acknowledged the value of having the inbuilt calculator within their devices.

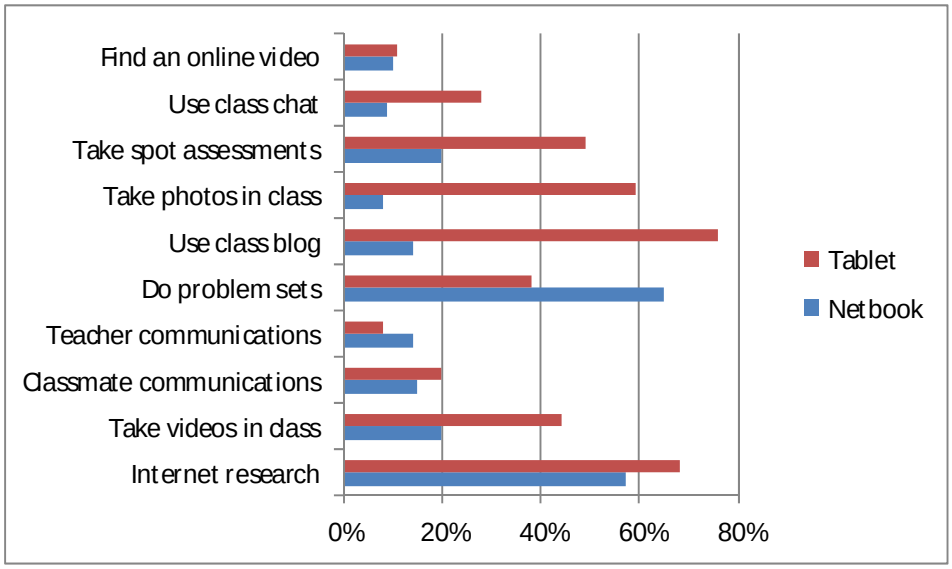
Chart 1: How Algebra I Students are Using Mobile Devices – for Schoolwork Effectiveness



The more interesting part of the story, however, is how the students are enabling a more personalized learning environment

with the features of their respective devices. Chart 2 documents the various ways that students are tapping into their netbooks and tablets for that purpose, and the differences in that usage.

Chart 2: How Algebra I Students are Using Mobile Devices – to



Personalize Learning

In this evaluation, we see more dramatic differences between the usage of the tablet and the netbook. The functionality inherent in the tablet to easily accommodate video production, photography and social media usage is evident in the usage patterns by the students with the tablets. Interestingly, however, the use of the Project K-Nect legacy problem sets developed especially for the earlier implementation with the smartphones appears to be more widespread within the netbook using classes than those with tablets.

One of the underlying principles of personalized learning is the ability for the student and teacher to choose the right tool for the right task at the right time. As evidenced by the variety in the usage of the netbooks and the tablets, it appears that both students and teachers within Onslow County Schools have adopted that principle wholeheartedly. There is no single perfect mobile device for student use and the students in the focus group artfully articulated both the pros and cons of both devices under evaluation. As noted in Table 1, the students' value proposition around the use of the mobile devices in some cases was device dependent, in other cases, the premium of having a personal mobile device for use in math class was the overriding winning benefit.

Table 1: Benefits of Using a Mobile Device

Benefits of Mobile Devices Within Math Class	Netbook User	Tablet User
I can access online textbooks anytime I want	29%	15%
I can communicate more with my teacher	8%	13%
I am more engaged in class	20%	34%
I feel that instruction is more personalized to my needs	19%	26%
I can review class materials whenever I want	38%	36%
I like having a device that I don't need to share	26%	45%
The device makes it easier and faster for me to access the Internet	25%	44%

The benefit of having a device that does not need to be shared with anyone else was a significant topic of discussion in our student focus groups, and paralleled other discussions that we have had with students nationwide. In many cases, the students told us that while they had high speed Internet access at home on their family computer, contention for that access with other family members often limited or prohibited their ability to get online at all outside of school. Having a personal device with Internet connectivity provides them with the ability to manage their own access time. When asked if they ever allow their parents or siblings to use their mobile device when at home, the students' response was resounding: Never!

While many schools are providing students with access to mobile devices during class time with class sets of tablets, netbooks and laptops, the environment within Onslow with personally assigned devices is fundamentally different, with different results. Having a mobile device that can be customized with features, settings and applications that meet individual needs creates a stronger personal affinity for that device and thus a higher value proposition on both its care and its importance in the learning process. The Onslow students realize that it is a privilege to have access to a school provided mobile device for their learning purposes both in and out of school, and thus, they are very respectful of the rules associated with that usage and the potential benefits of the opportunity.

Student Self-efficacy for Math

While it has become socially acceptable to lament about one's dislike of math, or lack of confidence in one's abilities to be successful in math, the prevailing opinion especially amongst employers is that today's students all need a solid foundation in mathematical literacies to successfully compete and participate in the information intensive global economy. Math proficiency is no longer just for the students interested in a STEM career. To that end, one of the goals of the Onslow 1-to-1 Math Initiative is to change students' self-perceptions on math and their potential for a job or career that includes math. The task is not a trivial one. Based upon the feedback from the students in the project, only one-third (38 percent) indicated that they like math and only 25 percent consider math an easy subject to learn.

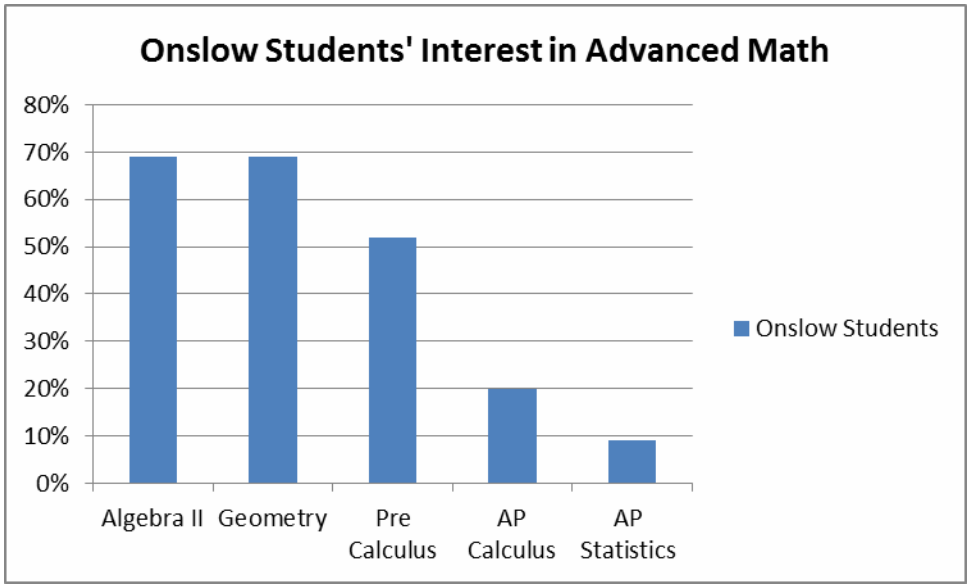
The potential for this program using mobile devices in math class, and especially tablets, to transform the learning process is very promising, however, with continued implementation.

Approximately one-fifth to one-fourth of the students with tablets note a change in their self-perception of math because of having the mobile device. Based upon the survey responses:

- **22 percent of the students with tablets say that their understanding of math has improved**
- **22 percent also say that they are more confident in their abilities to be successful in math class**
- **23 percent say "math is easier for me now!"**
- **26 percent say that they like math more now**

This change in self-efficacy is even more tangible when we look at the students' interests in taking additional math classes in high school and exploring a college major or job that uses math. As noted in Chart 3, students using the devices are highly motivated to take on advanced math classes including Pre Calculus and Advanced Placement courses.

Chart 3: What additional math classes are you interested in taking before you graduate from high school?



Students' expectations regarding their future math experiences also increased from fall to spring. Interest in taking Algebra II increased by 13 percent from fall to spring and interest in Geometry grew by 10 percent. While this shift in attitudes about math cannot be wholly attributed to the inclusion of the mobile devices in their classes, we believe that that the students' increased engagement in learning over the school year is a meaningful driver for these new attitudes.

The number of students who see themselves in an AP Calculus class is also particularly significant. Nationwide, approximately 8 percent of all high school students take an AP Calculus math class. Within the cohort of the mobile-using students in Onslow County, 20 percent visualize themselves in that class already. Moreover, in terms of thinking beyond high school, the students that have been engaged in this highly personalized learning environment with the mobile devices are more likely to see themselves majoring in or pursuing a job that involves math. While only 23 percent of high school students nationwide indicate on the national Speak Up surveys an interest in any of the STEM fields, 55 percent of Onslow students say further study in math and a possible math-related career is in their future.

Student Self-efficacy for 21st Century Workplace Skills

Today's students are keenly aware and interested in their development of appropriate workplace skills, more so than any previous generation of students. For many students, the use of emerging technologies and a learning environment that supports project based learning are effective tools for developing employer-desired skills such as teamwork, communications and critical thinking. The students in the Onslow 1-to-1 Math Initiative are in alignment with their national peers on their evaluation of the

importance of these skills for future success; and in some cases, their value proposition actually exceeds students in other communities.

When asked to identify the 21st century workplace skills that they believe are very important for their future success, the Onslow students ranked the skills in this order:

1. **Communications skills – both verbal and written (72%)**
2. **Ability to understand your strengths and weaknesses (72%)**
3. **Having skills that are valued in the marketplace (71%)**
4. **Leadership skills (68%)**
5. **Collaboration and teamwork skills (67%)**
6. **Ability to think through complex problems and identify solutions (66%)**
7. **Ability to adapt to a changing environment (60%)**
8. **Creative expression of your own ideas (59%)**
9. **Using a variety of technology tools and services (59%)**
10. **Analyzing and interpreting information from a multitude of sources (56%)**
11. **Empathy for others (42%)**
12. **Understanding global issues (42%)**

Compared to other Project Tomorrow study groups of high school students, the students in the Onslow 1-to-1 Math Initiative outpaced their peers in three of these categories: communications skills, collaboration and teamwork skills, and using technology tools and services. In reviewing the types of activities that the Onslow students are doing with their mobile devices this difference makes sense. The Onslow students are provided with almost daily opportunities to develop their communications skills through blogs, wikis and writing exercises

in math, to learn good strategies for collaborations through project based learning environments, and to develop an appreciation for using a wide range of different emerging technologies within learning. The first hand experiences, therefore, translate into stronger value propositions around these particular 21st century skills in addition to the intrinsic learning value of the skill development.

In terms of understanding how the use of the mobile devices affects this developmental process, many students attribute their increased aptitude for these skills to the mobile learning platform in use in their class. Approximately one-quarter of the students who are using tablets (24 percent) say that having access to those devices has resulted in an improvement in their critical thinking, problem solving and teamwork skills. An additional 16 percent of the students say that their communications skills have improved because of their use of a tablet in math class. In addition, 22 percent of the Onslow students from Southwest High School and Richlands High School specifically note that they are using their mobile device to help with self-organization of their schoolwork, thus driving a greater sense of academic independence, another highly valued skill for college success.

Student Visions for Mobile Learning

As part of the evaluation survey, the students were asked to imagine being a math teacher at their school, and to think about how they would use a mobile device like a tablet or netbook within instruction and to explain how their math class would be different from other classes at the school. This question provided an optimum environment for evaluating student perceptions on the purpose and value of using a mobile device within learning. It also provided a unique way to see how students would improve upon

the implementation – if they were sitting in their teacher's chair. The following sampling from the student comments gives us an invaluable glimpse into the future of mobile learning and the students' vision of their ultimate math class.

"I would let each of my students have a tablet. We would play math games almost every day because most people learn better by hands-on experiences."

"I would use a mobile device for group discussions and activities. I think it would help students understand the subject better because they would have the work and materials right in front of them and they would be able to work at their own pace."

"I would allow my students more freedom in the class to express their ideas on solving problems."

"I think that a tablet or netbook would be fine either way. If I was a teacher, I would use these devices to help kids with their math and to get their confidence up on working with math problems."

"I would communicate with my students more through email on the tablets."

"I would make videos me teaching my math class, and I'd feed them more information than they do now. My class would stay on top because of the teaching techniques I use."

"If I were a math teacher, I would encourage my students to communicate using these devices and work together to teach them better communications and teamwork skills."

"I'd use it every day with my students."

“My math class would be different because my class would be more hands-on activities and being able to act out certain problems while video recording them, and learning from each other’s projects and ideas.”

“My math class would be different because more people would be interested and not always saying that they hate math.”

“I would stay at home and have the students watch me on video.”

“If I was the math teacher I would have the textbook online and take the books away and not have it in class at all. The tablet is easier to use than the book. Some people learn better on the computer.”

“I would use the social networking sites as examples in problems and have the tablets used for research and development in the technology skill set.”

“I think it would be better to have a group video chat that would give the opportunity for students to see and talk to one another while working on math problems.”

“I would assign projects that have to do with math and researching information. I would let them use the calculator if its needed.”

“I would let my students use tablets like the ones we have. I would also have blogs and other ways they could find help if needed. My class would be the best because the students would be more involved in the class.”

“I think we should use tablets and netbooks in every class. It helps me learn better.”

Ending Thoughts: Considerations for Future Mobile Learning Initiatives

In many ways, Onslow County Schools with their innovative approaches to mobile learning and sustained support structure has served as a unique national laboratory for effective practices for implementation. Too often with emerging technology initiatives, the focus is on short-term results without a more in-depth understanding of the complexities associated with systemic change in school culture and teacher practice. The lessons learned from the past year's widespread implementations of tablets and netbooks in high school math classes continues to provide the district and the nation with rich input for improving future initiatives.

One of the key components of the Onslow 1-to-1 Math Initiative has been the pervasiveness of the usage of the mobile devices by the students and the teachers in the classroom. The integration of the devices into the daily instructional plan in Onslow, therefore, brings up new questions about the practicalities or logistics associated with regular usage. These "nuts and bolts" issues are often stumbling blocks for other districts interested in exploring mobile learning and so, the insights from the Onslow classrooms are especially informative. To understand some of these issues, we asked students to identify the primary obstacles they face using the mobile devices at school. Table 2 documents the views of the Algebra I students using tablets and netbooks.

Table 2: What obstacles do you face using your mobile device at school?

Obstacles	Netbook User	Tablet User
Difficulty in connecting to the Internet	35%	44%
Forgetting to charge the device at night	40%	65%
Keyboard is too small for my work	26%	9%
Takes too long to start up	48%	16%
Device is too big to carry around	21%	10%
Forgetting to bring the device to school every day	20%	13%
Battery problems	18%	14%
Can't get to websites or applications that are blocked by the school firewall	44%	51%
Not having access to social networking sites	34%	31%
Can't download games or applications without permission	13%	28%

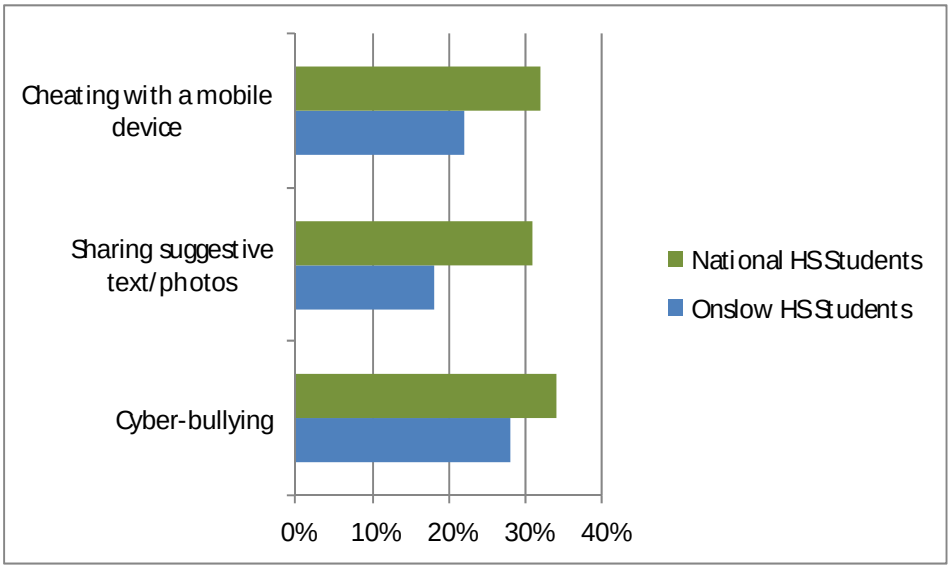
Many of these obstacles were also discussed in our student focus groups. Forgetting to charge their devices appear to be a significant issue for many students. The result is a need for additional charging time and outlets in the classroom. Students' complaints about not being able to access certain websites or applications due to school filtering are a common challenge named by students. From the 2011 Speak Up National Results, 59 percent of high school students identified that same obstacle to using technology in general at school. The device specific obstacles on the list are also important input for future considerations. The always-on capabilities of the tablet mimic more closely how students want to access information, resources

and the Internet versus the more traditional computer "startup/log in" steps with the netbook.

Some districts contemplating a mobile learning initiative also identify a concern about parental support for such programs. Again, the work in Onslow County can provide valuable new insights on this topic as well. Three-quarters (74 percent) of the students in the Onslow program said that their parents are supportive of the use of the mobile devices for schoolwork, with 31 percent noting a "very supportive and excited level" for the program. Some students noted that while their parents were supportive of the initiative, they were also concerned about the device being stolen or broken (28 percent). However, 17 percent of the students acknowledged that their parents did not really understand how technology or the mobile devices specifically would be used to support math instruction. The Speak Up national data findings confirm the high value that parents place on the role of technology within learning, including the emerging use of mobile devices such as within Onslow County, and the need for schools and districts to fully engage parents in these discussions.

From the Speak Up data findings, we also know that parents continue to be concerned about safety issues around technology and Internet usage by their children. The increasing access that students have to mobile devices and several high profile media stories are exacerbating those concerns. Some districts may therefore be hesitant to adopt a mobile learning platform within their schools for fear of opening up a Pandora's Box of potential safety issues. Interestingly, the students in Onslow County who have personal access to a school provided tablet or netbook actually report significantly less inappropriate behavior with technology than their national peers as illustrated in Chart 3.

Chart 3: Problems Experienced by Students at Your School



This suggests to us that the deliberately constructive use of mobile devices and technology in general for academic purposes in an engaging learning environment creates a healthy atmosphere for student usage. While it is unrealistic to think that all inappropriate behavior by teenagers can be eliminated or avoided, the experiences in Onslow County provide new important insights into not only the effective use of these devices within learning, and how to position the value of mobile learning with parents.

About Project Tomorrow

Project Tomorrow®, the national education nonprofit organization dedicated to empowering student voices in education discussions, prepared this program evaluation for Onslow County Schools.

Project Tomorrow has 16 years of experience in the K-12 education sector and regularly provides consulting and research support to school districts, government agencies, business and higher education about key trends in K-12 science, math and technology education. For the past four years, Project Tomorrow has served as the external evaluator for the Project K-Nect implementation within Onslow County Schools. The organization therefore brings to this discussion an in-depth understanding of the school district and the community, and the growth of the mobile learning implementations.

Data collected through Project Tomorrow's Speak Up National Research Project is also included in this report. Since the Speak Up project's inception over 2.6 million students, teachers, parents and administrators have shared their views through annual online surveys. The data represents the largest, authentic, unfiltered dataset from educational stakeholders and federal, state and local policymakers use the findings regularly to inform programs and funding for education initiatives. More information about Project Tomorrow and Speak Up is available at www.tomorrow.org.

Addendum B:

Previous Mobile Deployment Evaluation Results

Introduction

This Evaluation Report builds on the program evaluation conducted Sept 2009 through May 2010 for the Project K-Nect program in Onslow County Schools (NC) for Digital Millennial Consulting by Project Tomorrow and highlights the current findings for the period Aug 2010 – Jan 2011. As Project K-Nect entered its third year of implementation in Onslow County School District, the fall 2010 cohort was comprised of 59 students and three teachers from Algebra I, Algebra II and pre-calculus courses at Dixon High School and Southwest High School. The participating teachers have a long-standing relationship with Project K-Nect and an understanding of the value that smart phones and the Project K-Nect tools provide to their students. Project K-Nect continues to serve as a demonstration project highlighting the curricular uses of smart phones, and more recently net books with Onslow Connect, to increase student achievement and decrease the digital access gap amongst students.

Students in Onslow County schools are required to complete four credits in math for graduation (Algebra I, Geometry, Algebra II and one other math course). Participating teachers have integrated Project K-Nect and the smart phones into a course sequence comprised of Algebra I (semester), Geometry (semester),

Algebra II (semester) and pre-calculus/Advanced Placement Calculus (year). Project K-Nect is included in the pre-calculus/Advanced Placement Calculus class at Southwest High School only. Students typically complete the Project K-Nect course sequence in five semesters and meet both their high school graduation and college admissions requirements. The district measures student proficiency in math through the state-administered end-of-course assessments for Algebra I, Geometry and Algebra II. Students participating in Advanced Placement Calculus and Advanced Placement Statistics have the option to take Advanced Placement exams upon completion of their course.

Participating Project K-Nect teachers use many of the standard features of the smart phone, as well as the algebraic problem sets and a mobile-enabled suite of tools for sharing student work, facilitating collaboration between students and assessing student activity and growth. To help students master math concepts, teachers are encouraged to create problem-based lessons and activities that utilize the features and functionality of the smart phones as well as the Project K-Nect environment. Teachers have the flexibility to select the Project K-Nect components that best meet their instructional needs in the classroom and, as such, students have a variety of experiences and utilize the smart phones and tools to varying degrees. During their participation in the Project K-Nect classes, students are given a smart phone with a data plan that allows for 24/7 access to the internet and Project K-Nect environment enabling them to be online and connected with their teacher and other students anytime in or out of school.

Teachers and administrators report that the introduction of Project K-Nect in these pilot schools has resulted in more students pursing advanced math courses during high school. As one Project K-Nect teacher noted, **"...it is a major accomplishment for these students to have grown academically, emotionally and socially to undertake the course load that an AP Class involves."** Appendix A illustrates the student cohort groups who have and are participating in Project K-Nect. This report highlights the results of fall 2010 and includes data collected from students through pre and post student focus groups, pre and post attitudinal surveys and Project Tomorrow's Speak Up survey as well as data collected from teachers through classroom observations, informal interviews and email. As of the writing of this report students' utilization data from the smart phone was unavailable.

Methodology

During August 2010, Project Tomorrow staff visited Onslow County Schools and conducted classroom observations and student focus groups with students who were new to the Project K-Nect program. The focus groups were audio taped for subsequent transcription. In Dec 2010, Project Tomorrow staff returned to Onslow County schools to facilitate a post focus group with the students and observe the Algebra I math class.

Pre and post surveys: Teachers administered online pre and post surveys developed by Project Tomorrow. Project Tomorrow staff provided the high school advisors with a URL, and the teachers administered the online survey during class time. Thirty five of the thirty-nine Algebra I and Algebra II students participated in the pre-survey (90 percent) and thirty four participated in the post survey (87 percent). The Calculus students who were new to Project K-Nect did not participate in the pre or post surveys.

Post assessments: Staff from Project Tomorrow and Onslow County Schools worked together to collect and summarize available data from the end-of-course exams for Algebra I and Algebra II. Currently assessment instruments are not available for pre-calculus.

Speak Up Benchmarks: The program evaluation includes specific Speak Up benchmarks to provide additional context and perspective regarding the use of technology for learning in the following areas:

- **Measures of implementation**: As a counter point to the Project K-Nect data and to assist with developing guidelines for future implementations, Speak Up data is included for the question *"How could your school make it easier for you to use technology for schoolwork?"*

- **Technology Utilization**: To gain a broader perspective about the effective uses of technology for instruction, the following Speak Up questions are included *"How are you using technology for schoolwork?*", *"How would you like to use mobile devices for school*

work?" and *"What Internet based tools or applications do you use outside of school?".*

The Speak Up 2010 survey was open for input between Oct and Jan 2011. Project Tomorrow staff notified the Project K-Nect advisors via email and provided the survey link. Fifty-six 9th-12th grade students participated in the survey (95 percent of the Project K-Nect students).

Pre and Post Student Assessments: In order to streamline the evaluation process and align it with other initiatives within the district, staff from Onslow County School District is in the process of revising the pre-assessment instruments for Algebra I, Algebra II and pre-calculus. The pre-assessments are unavailable for fall 2010; hence, only the standardized post-assessments are available for inclusion in the program evaluation. Project Tomorrow staff compiled aggregated end-of-course test results from the teachers and staff from Onslow County School District. Additional data is required from Onslow County School District in order to draw comparisons between Project K-Nect students and the general student population.

Findings

Students report they like using the smart phone to learn because:

"..I find it helpful because students can IM each other to get help with a problem in class..."

"…sometimes it is easier to learn when another student explains it..."

"..they make class fun for the students and the teacher..."

"..it's easier to get the help you need in order to complete your assignment..."

"..It allows students to connect with their classmates… to help them with problems, and it gives them a familiar device to work with… you can pick up the smart phone and IM your teacher and or classmate... or you can look at a video that your former classmate posted to help you understand what you're doing wrong..."

The joint goal of Project K-Nect is to increase student achievement and decrease the digital access gap for students in participating schools. To determine if these goals are achieved the team collected background information from program records, student focus groups, pre and post surveys and the Speak Up 2010

survey. It is important to note that while Project K-Nect initially intended to serve a select cohort of students over time; in reality, students enter the program at various points in their math career. For example, during fall 2010, 50 percent of the Algebra I class included students who had previously taken Algebra I and failed, as well as a new cohort of ninth grade students. The Algebra II class was equally split between ninth grade students who successfully completed Algebra I during middle school and students from cohort 2.A.2 (see appendix A) that started in Jan 09. Lastly, the pre-calculus class was comprised of both students who had been involved with Project K-Nect since the beginning of their high school math career, as well as students introduced to Project K-Nect for the first time in fall 2010.

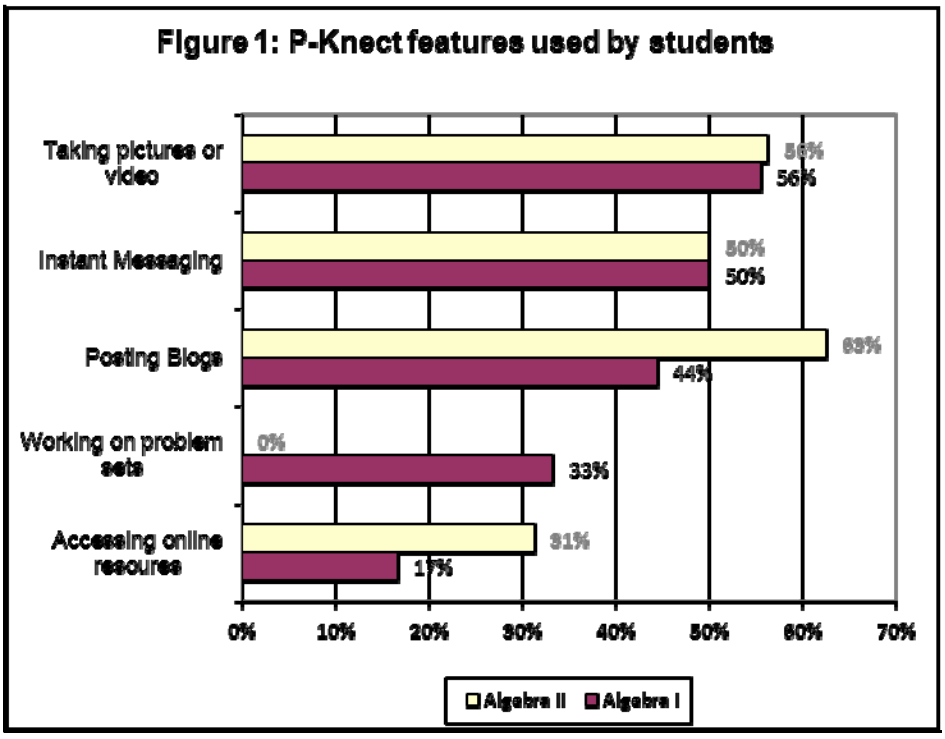
How are teachers using the Project K-Nect tools to facilitate learning? Which tools are used in the classroom? How are the tools used? What are the results?

The professional development model for Project K-Nect encourages teachers to use the smart phone features and Project K-Nect environment to facilitate collaboration, create relevant problem-based learning experiences and provide opportunities for students to capture and discuss their problem solving strategies using digital media. Teachers using the smart phone and Project K-Nect environment have the flexibility to adapt a diverse group of tools into their instructional practice providing a framework to **facilitate collaboration** through blogs, instant messaging and email, **capture, post and discuss problem-solving strategies** through digital photos and video capabilities or **practice algebra-based problem sets.** Teachers have also incorporated the use of geo-connectors to capture and illustrate math ideas, and Poll Everywhere that can be used with the smart phones to instantly assess students' understanding of key math concepts.

Interviews with teachers and students reveal that the smart phones are most tightly integrated into the Algebra I curriculum and to a lesser degree with Geometry, Algebra II, pre-calculus and AP calculus. Students in Algebra I report using instant messaging to communicate with their teachers or other students, photographing or videotaping their work as they solve problems using algebraic formulas and properties, posting their videos and communicating via the blogs and solving problem sets (figure 1). Currently, Project K-Nect does not have problem sets for Geometry, Algebra II or Calculus and, hence, participating teachers

typically create problems where students are required to apply their understanding of math. As a result, students are more likely to use the blog to upload homework assignments for review and discussion, instant message each other (or the teacher) for help and video or photograph math in a real-world context. Furthermore, the post survey revealed that Algebra II students are more likely than Algebra I students to use the smart phone to access other online resources. It is unknown if this behavior is the result of class assignments or because the class includes students who've been involved in Project K-Nect for an extended period of time and those students are more comfortable using the features of the devices for multiple purposes.

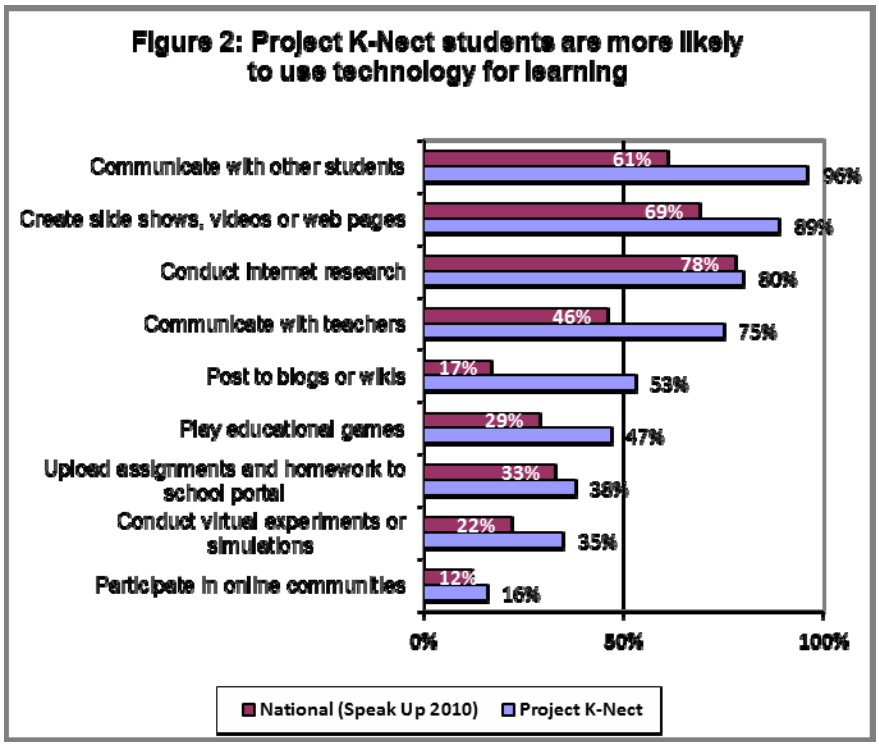
Teachers determine the degree to which they will integrate the Project K-Nect tools into daily instruction; as a result, the implementation varies by teacher and semester. During fall 2010, over one-half of the students in Algebra I reported using their smart phone 15-90 minutes per day while the majority of students in Algebra II used the smart phone less than 15 minutes per day



Students are comfortable using the Project K-Nect features. Overwhelmingly students agree they are comfortable using the smart phone features, sending instant messages and posting to blogs. As expected, students who reported using the smart phone features more often were also more comfortable using the

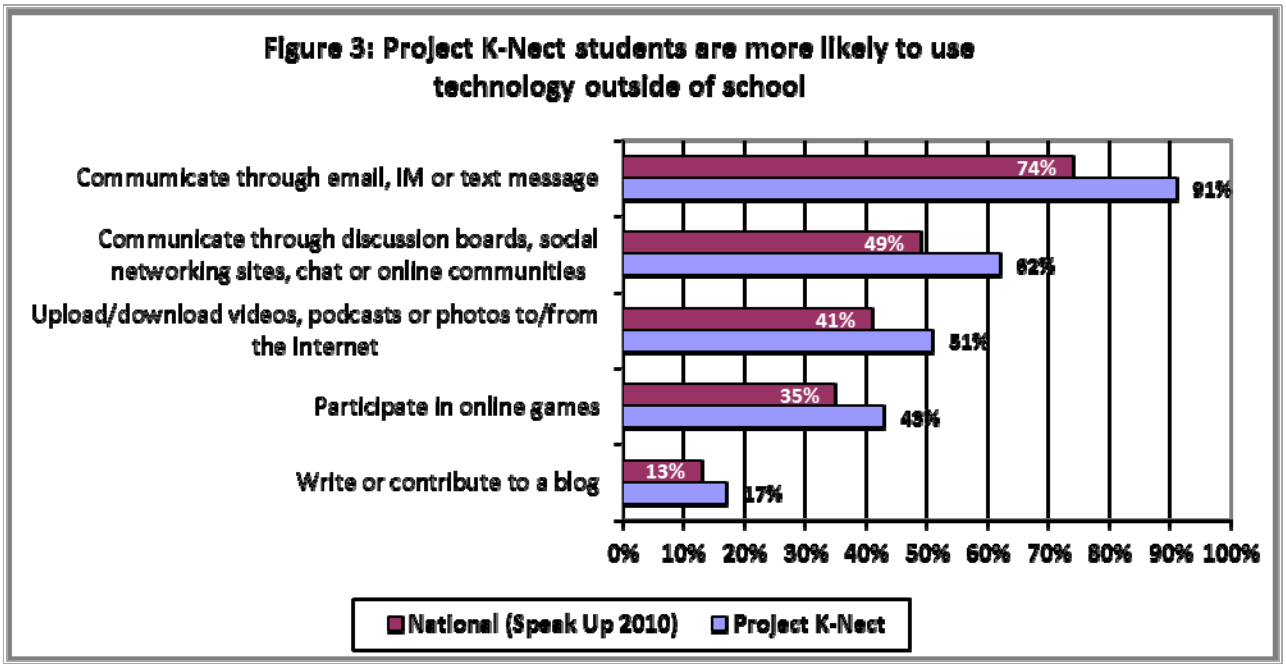
features. In some cases, students reported they were frustrated with a variety of hardware and software problems they experienced and recommended the possibility of using their own smart phones or cell phones (see Students' satisfaction with smart phones, page 11).

More students are using technology for schoolwork. Project K-Nect students are learning how to use, and seeking out new, resources to support their learning (figure 2). For example, Project K-nect students reported greater use of communications tools (via email, IM, text or chat) to communicate with students or teachers than high school students nationally (Speak Up 2010). They also are more likely to create slide shows, videos or webpages, post to online blogs or wikis, play educational games or conduct virtual experiments or simulations. For many of the Project K-Nect students, the smart phone provided a much needed connection for help and support, first with the teacher, and subsequently with other classmates; as well as access to additional resources to support their learning. This was especially critical for students who had not previously felt successful in math, according to Mrs. Kliewer, Algebra I teacher.



Furthermore, their increased use of technology is not limited to school. The Project K-Nect students are more likely to also use technology outside of school

compared to their peers nationally (figure 3). For example, they are more likely to communicate with others through email, IM or text message (91 percent), communicate via Web 2.0 tools, such as discussion boards, social networking sites, chat or online communities, (62 percent), upload/download videos, podcasts or photos to the Internet (51 percent), participate in online games (43 percent), or write or contribute to a blog (17 percent). Students increased use of and familiarity with technology through Project K-Nect helps students easily integrate the use of technology to other curricular areas.



How do students' perceptions about or interest in math change as a result of participating in Project K-Nect?

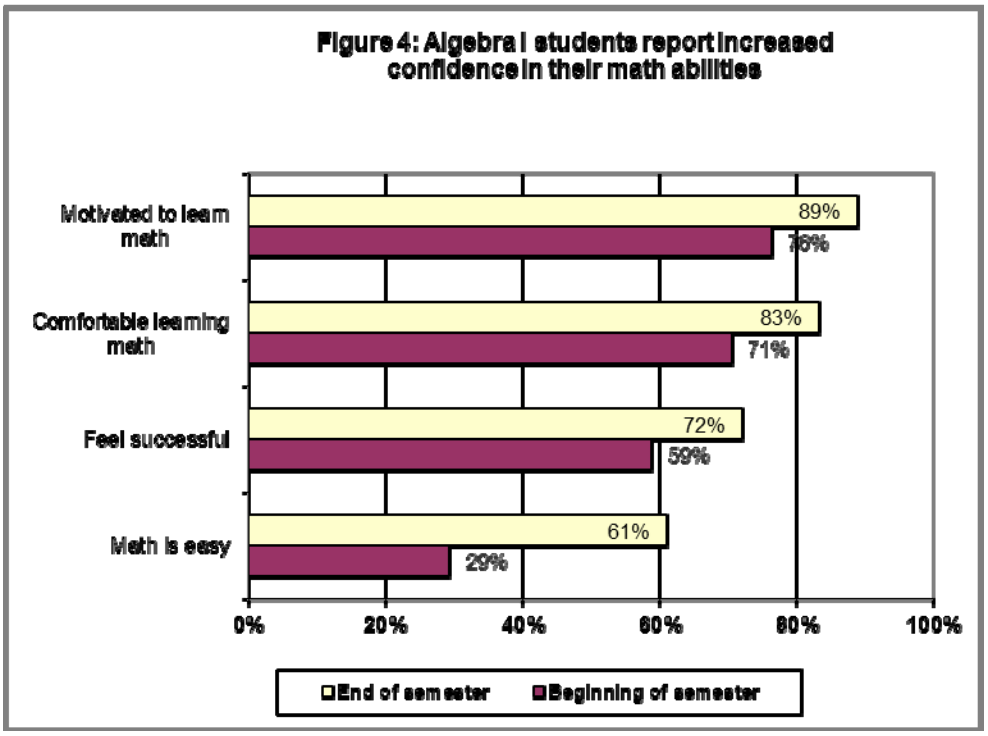
Project K-Nect helps students learn math by providing tools that:

- provide the ability to get help from their teacher or classmates during or after school
- provide immediate access to Internet resources to look up additional information
- empower students to talk about math and their problem solving strategies
- review how their classmates or teacher solved a problem via text or video
- practice solving problems through standards-based simulations
- give them the ability to capture and discuss the practical application of math

As teachers incorporate the Project K-Nect tools into their instructional strategies and students become more comfortable using the tools, their attitudes towards

math changes (figure 4) and they become more confident in their math abilities as illustrated in the responses from the Algebra I students during fall 2010.

Students' confidence in their math abilities increases. By the end of the fall 2010 semester, 89 percent of the Algebra I students reported they are more motivated to learn math compared to 76 percent at the beginning of the semester. The majority of students reported they are also more comfortable learning math (83 percent), felt more successful (72 percent) and better prepared to take the end-of course exam (72 percent). By the end of the semester, the number of students who thought, "math is easy" doubled indicating a greater confidence in their ability to be successful in math.



Students report greater confidence in their ability to talk about math. A core instructional goal for Project K-Nect teachers is to help students become more fluent and comfortable talking about math. This goal is realized as students videotape their problem solving strategies, photograph and blog about their most recent assignments or teach each other via instant messaging. Participating teachers share that it takes time for students to feel comfortable talking about math and many times the process starts slowly with students requesting help from the teacher (via instant messaging). As their confidence increases, they begin to ask each other for help and when they become even more comfortable with math, they will begin to help their classmates. As a result of this focused-approach, by

the end of the semester, 83 percent of students reported they could explain how they solved a math problem compared to 72 percent at the beginning of the semester. Furthermore, about three-quarters of the students reported they are comfortable discussing solutions and feel confident talking about math. By the end of the semester students report an increased level of confidence and are more likely, to work with other students on math problems (89 percent) compared to the beginning of the semester (65 percent)

Students express an increased interest in college and math related degrees and careers. During the semester, Project K-Nect teachers assign their students activities designed to connect abstract math concepts to relevant problems outside the classroom. As a result of this instructional strategy, students gain a better understanding about the purpose and application of the math they are learning in the class; which, in turn, may inspire them to pursue advanced math course or careers that utilize math. We asked students to assess the influence that Project K-Nect had on their career or academic plans, one-quarter of the Algebra I students expressed an interest in taking additional math classes, including Advanced Placement courses. Furthermore, Algebra I students reported they are more interested in attending college (56 percent) or pursuing a degree or career that would use their math skills (33 percent). Students also reported an increased interest in joining the military (22 percent). The top career picks for Algebra I students included science related fields (including healthcare), engineering/technology or math related fields, entertainment and military, fire or law enforcement.

Are students who participate in Project K-Nect more likely to demonstrate proficiency in math than students who did not participate in the program? As of the writing of this evaluation report, end of course scores are available for Project K-Nect Algebra I and Algebra II courses only. Comparison scores for non-Project K-Nect classes, the district and state have not been provided. Ninety percent of the Algebra I students demonstrated proficiency on the end of course exam and 100 percent of the Algebra II students demonstrated proficiency. Furthermore in spring 2010, students from the first Project K-Nect cohort achieved another major accomplishment by successfully completing the college level AP Calculus college curriculum and taking the AP exam. Their accomplishment illustrates that through their participation in Project K-Nect these students “have

grown academically, emotionally and socially to undertake the course load that an AP class involves," shared Mr. Kliewer, AP Calculus Teacher.

What are teachers' perceptions about students' interest and proficiency in math?

For fall 2010, the Algebra II class was comprised of students who previously participated in Project K-Nect, as well as ninth grade students who completed Algebra I in middle school. While Mr. Spring, Algebra II teacher, did not comment specifically on his students' interest and proficiency in math as a result of Project K-Nect; he observed that today, students appeared more at ease with the technology tools compared to the initial Project K-Nect start-up. During his interview, he also shared that students have greater access to technology compared to the beginning of the project and many students expressed a desire to use their own mobile devices. In general, Mr. Spring noted that students in his Algebra I classes were more likely than students in his Algebra II classes to use the features and functionality of the smart phone suggesting a need to update the Project K-Nect curriculum to meet the specific learning outcomes of each course. Furthermore, Ms. Kleiwer, Algebra I teacher, noted that in the classes where she tightly integrated the Algebra I problem sets into the curriculum and students regularly used the Project K-Nect features, they demonstrated a better understanding of the course material supporting the idea that increased access and use will reduce the digital access gap and increase student achievement in math.

How can the mobile learning experience be improved?

"Instant messaging was a helpful way to help other people when they didn't know how to solve a problem."

"I was able to ask other people how they solved a problem when I didn't have a clue."

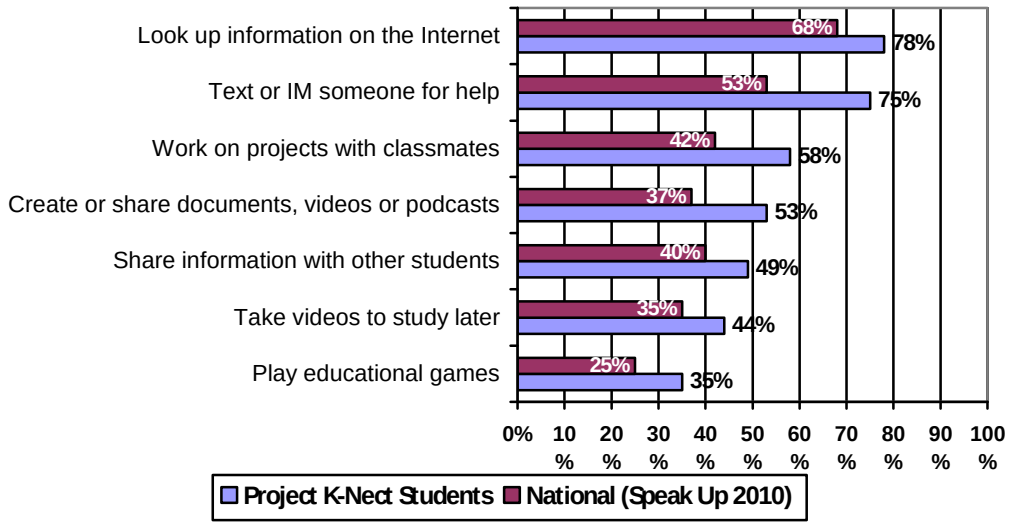
"I found the blogs helpful because you could look at other people's blogs to see how they solved a problem (sic)."

Project K-Nect helps close the digital access gap. Project K-Nect continues to provide a critical link to the internet for many of the participating students. While 100 percent of the Algebra II students report they have fast internet access at home, about 30 percent of the Algebra I students still do not have this same level

of access. For these students, Project K-Nect continues to provide a crucial connection to the internet, their teacher and fellow classmates.

Project K-Nect students highlight strategies for integrating mobile devices into instruction. As a result of participating in Project K-Nect, students realize the value of using mobile devices for learning (figure 5). When asked how they would use mobile devices to help with schoolwork, Project K-Nect students were more likely, than their peers nationally, to use mobile devices to look up information on the internet, text or IM some to get help with school work, work on projects and share information with their classmates, create or share documents, videos or podcasts, take videos of class presentations or experiments to study later and play educational games (Speak Up 2010).

Figure 5: Project K-Nect students demonstrate value of mobile devices for instruction



Students' satisfaction with the smart phones and Project K-Nect environment. Overall students appreciate and value the mobility and opportunities for collaboration that smart phones afford them. However, students continue to voice concerns about the low battery life, sensitive screens, "freezing up, " "delayed response times in loading programs," internet access problems, inconsistent access to Instant Messenger and the inability to queue messages. Furthermore, students are frustrated by the process for uploading videos and identifying who is active or online in the community at any particular point in time. As a result of these frustrations, many students reported they would like to use

their own cell phones and smart phones to text a classmate for help. Students had a variety of recommendations to improve the current environment including:

- **Instant/Text Messaging:** To minimize their frustration with the instant messaging feature in Project K-Nect, students suggested providing the ability to queue instant messages and attach photos to an instant message. Alternatively, many students suggested the possibility of using their own cell phones to send text messages. While this solution is expedient for students who have access to their own personal smart phones or cell phones, it does not address the primary goals of Project K-Nect to provide internet access and a safe collaborative working environment for all students. Allowing students to use their own cell or smart phones with the Project K-Nect environment requires careful planning to ensure that all students have the ability to actively participate in the environment and that the issues of student safety and security are addressed.

- **Uploading videos/Blogging:** Streamline the process so that it is easier to both upload the videos and subsequently view the videos and blogs at a later date.

- **Additional resources:** Students would like a centralized website with resources they can use for math, as well as greater access to resources on the internet. Students reported that many resources were blocked.

- **Collaboration tools:** Project K-Nect provides many of the tools that students across the nation want to use to collaborate, including: instant or text messaging, an online environment that allows them to connect with their teacher or other students, and blogs or wikis. Students participating in Project K-Nect also show strong preferences for using online chat, social networking sites (such as Facebook), Skype and Webcams to facilitate collaboration (Speak Up 2010).

Recommendations/Next Steps

Through focus groups, discussions and interviews students and teachers had a variety of recommendations outlined below:

Do you think the smart phone could help you in your other classes as well? Which classes and why?

The majority of Algebra I students (89 percent) report they would use a smart phone for other classes if it were available and allowed. Top recommendations include world history, English, Health and science. Students value the mobility and access the smart phone provides; however, many students would like a "cross" between a smart phone and iPad in order to take advantage of a larger screen, "pull-out" keyboard and greater functionality. If students could design their own Project K-Nect mobile device they would recommend a device larger than a smart phone and smaller than an iPad with both a touch screen and keyboard to meet their individual preferences. The device would include access to online textbooks, text messaging, screen capture capabilities to capture and share how they solved a problem, and the ability to take notes and email them.

How can we make it easier for students to use technology for schoolwork?

As the team considers future expansion, Project K-Nect students provide valuable insight and ideas for improving technology access. The top priority for Project K-Nect students, compared to their peers nationally, is greater access to the websites they need (84 percent) and tools that facilitate communication with their teachers (42 percent) and communication and collaboration with their classmates (38 percent). As the team considers expansion and sustainability, it is important to consider the digital access gap in Onslow County Schools as reflected amongst the Project K-Nect students. Currently, 27 percent of Project K-Nect students suggest the school should provide them with laptops or other mobile devices for school use. By contrast, about two-thirds of the Project K-Nect students prefer using their own mobile devices, such as cell phone, smart phone or MP3 player and about 50 percent want to use their own laptops or netbooks (Speak Up 2010).

How do we effectively leverage smart phones for learning?

Although Project K-Nect is currently integrated into the suite of high school math courses, Mr. Spring and Mrs. Kliewer noted that some the features and functionality are not as well suited for the expected learning outcomes in Algebra II, Geometry, Calculus or Statistics. The current environment and problem sets provide a rich framework for teaching Algebra I and helping students learn how to work together, ask for help, discuss problem-solving strategies, or practice concepts from Algebra I. However, the tools (as provided) do not effectively support students as they progress through geometry, Algebra II, calculus and statistics. In these classes, students are required to think more abstractly, and

collect and analyze data using the mathematical concepts and equations they have learned in previous semesters; as such, the current features and functionality are not as well suited for these specific learning outcomes. Based on the course requirements, new assignments and problem sets should be created that would more effectively leverage the Project K-Nect tools (such as blogging, videotaping or IM) for the smart phone or another device in these more advanced math courses. We recommend working with the team to identify specific Project K-Nect learning outcomes and activities to help students achieve the specific outcomes. Once defined, the appropriate device and tools can be selected to achieve the recommended goals.

As this report demonstrates, there is much to be gained from mobile learning initiatives and we will continue to work with the team to share their successes with other educators.